

Association of bronchial asthma and allergic rhinitis with IgE mediated allergy to common food allergens

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Abstract

Background and objective: Prevalence of immunoglobulin (Ig) E-mediated food allergy is primarily reported in patients of all age groups. The present study was aimed to investigate the relative prevalence of food allergy and allergens in patients with bronchial asthma and allergic rhinitis. **Methods:** Patients of all age groups and both sexes were screened using standard questionnaire and skin prick-test (SPT) with common foods. Specific IgE level was determined by enzyme linked immunosorbent assay (ELISA) and allergy was established. **Results:** Of 575 patients screened, 120 (21%) gave history of food allergy. Of the history positive patients skin tested all showed a marked positive reaction to food extracts. Egg whole, black gram and lemon elicited marked positive SPT reaction in maximum of 12 (10%) cases each followed by rice, mushroom and corn in 11 cases each (9.1%), milk and cheese 10 cases each (8.3%), paneer and sardine fish 9 cases each (7.5%), maize and tamarind 8 cases each (6.6%), peanut and brinjal 7 cases each (5.8%), garlic and cabbage 4 cases each (3.3%), banana, sago and mutton 3 cases each (2.5%), pineapple, pork, potato and almond with 2 cases each (1.6%), 1 case of beef, lady finger and drumstick (0.8%). The SPT positive patients showed elevated specific IgE levels (range: 0.8-79 IU/mL) against respective food allergens than normal controls (0.73 IU/mL, mean±2SD). The prevalence of food allergy was estimated to be 4.5% (2.6%-6.34%) at 95% confidence interval (95% CI) in test population (n=470). **Conclusions:** Food allergy is estimated to be 21% in adolescents and adults with asthma, rhinitis or both. Many food allergens were recorded as per the test.

Keywords: Asthma, Immunoglobulin E, Rhinitis Allergic, Skin test

Introduction

Asthma and other allergic conditions such as allergic rhinitis are major public health problems in many countries. The incidence of these allergies has been increasing worldwide over the recent years [1]. Total serum IgE measuring and skin prick testing are the simple and available tools for evaluation of allergic patients and determination of the diseases frequency in communities [2].

Recent estimates suggest that IgE-mediated food allergy affects approximately 6% to 8% of children and about 3-4% of adults with asthma [3-6] food sensitisation in early infancy could lead to the development of respiratory allergy and is a significant risk factor for asthma in 10% to 53% of cases [7-9]. Allergic

rhinitis has also become a frequent respiratory manifestation affecting 20% of food allergic population [9-11].

The epidemiology of food allergy is influenced by genetic, cultural and geographical dietary influences. Recent studies [12-15] in India suggest a considerable increase in the prevalence of bronchial asthma (3.9%-11.6%) than reported earlier. Food such as egg, milk, cereals and legumes, commonly induce IgE-mediated reactions in children and adult population in the country [16-18].

The interrelationships between FA and respiratory manifestations [asthma, allergic rhinitis (AR), exercise-induced bronchial hyper-responsiveness (EIB)] although investigated in patient-based studies have been scarcely examined at the population level.

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The present study was undertaken to investigate the relative prevalence of food allergens which cause IgE-mediated reactions in children and adults with asthma, allergic rhinitis or both.

Material and methods

Study Population: Study population included patients of all age groups and both sexes (n=575) (mean age 30±12 years; range 12-62 years) with asthma and allergic rhinitis or both. The patients of respiratory allergy (history) included in the study during 2014-2015 for their allergy diagnosis and treatment at out-patient department, CMCH, Bhopal. The subjects were screened for food allergy using a detailed questionnaire.

The questionnaire also included the patient's details relevant to dietary habits in Indian subcontinent. In all of them, a detailed history was recorded and radiographs of chest and paranasal sinuses, spirometry and blood analysis were performed.

The diagnosis of asthma and rhinitis were ascertained as per the American Thoracic Society (ATS) guidelines [19] and Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines [20]. Diagnosis of food allergy was made by skin prick test (SPT) and specific IgE estimation by enzyme linked immunosorbent assay (ELISA).

Skin prick test and sera collection: The SPTs were performed with common food and inhalant allergens from pollens, fungi and insects. Histamine diphosphate (5mg/mL) and phosphate buffer saline (PBS) were used as positive and negative controls, respectively. A drop of the extract was placed on the volar aspect of the forearm and the skin was pricked by a 26 1/2" G sterile needle. Skin tests were graded after 20 minutes. The SPT reactions with wheal diameter that was 3 mm or greater than the reading in the negative control was considered as a "marked positive reaction".

Specific IgE estimation- Specific IgE in patient's sera was determined by ELISA. Mean±2SD of normal controls was taken as cut-off for ELISA positive results.

Statistical analysis was done

Results

575 patients with asthma, allergic rhinitis or both who presented to the OPD were examined. Skin prick tests with food extracts was performed on 120 (20.8%)

history positive cases with asthma, rhinitis or both. Patients with asthma and rhinitis showed maximum positive SPT reactions (40.8%) followed by bronchial asthma (32.1%) and allergic rhinitis (27.1%). Egg whole, black gram and lemon elicited marked positive SPT reaction in maximum of 12 (10%) cases each followed by rice, mushroom and corn in 11 cases each (9.1%), milk and cheese 10 cases each (8.3%), paneer and sardine fish 9 cases each (7.5%), maize and tamarind 8 cases each (6.6%), peanut and brinjal 7 cases each (5.8%), garlic and cabbage 4 cases each (3.3%), banana, sago and mutton 3 cases each (2.5%), pineapple, pork, potato and almond with 2 cases each (1.6%), 1 case of beef, lady finger and drumstick (0.8%).

Specific IgE Estimation: Specific IgE was determined in sera of patients showing marked positive SPT to food extracts. Of 120 tests done with patient's serum samples against different foods, 74 patients (61.6%) demonstrated ELISA positive results. Elevated specific IgE (0.80-79 IU/mL) was observed to one or more food than normal controls 0.78 IU/mL (\geq mean+2 SD). Maximum number of patients showed elevated specific IgE against lemon and black gram (n=8) followed by egg (n=7) and each of rice and mushroom (n=4 each), fish and milk (n=3), maize (n=2), brinjal, paneer, cheese, beef and pork pea (n=1 each).

Discussion

Studies on IgE-mediated food allergy and allergens are primarily focused on general paediatric or adult population. These reports suggest that foods play an important role in exacerbation and continuance of respiratory manifestations [11, 21].

But the true prevalence of IgE-mediated food allergy in the population with respiratory allergy is unknown. The present study was undertaken to identify the prevalence of IgE-mediated food allergy and allergens in the children and adult population with asthma, rhinitis and/or both. Various foods have been implicated as trigger factors in different geographical regions. [3-6]. Rice is detected as an important allergen in Thailand (ranked 4th), Japan (5th) and Indonesia (6th) [22] blackgram are reported as major food allergens from India and lentil from Mediterranean countries [18,23,24].

In the present study, Blackgram elicited marked positive SPT in (10%) cases may be due to its high

consumption by Indian population. Rice was the secondmost common offender afflicting sensitisation in 9.1% cases. Peanut which rank among the top eight food allergens in US and Europe [3,6] exhibited positive skin reactions in only 5.8% of our patients.

Lemon proved one of the highest important offender in our test population. Higher sensitization to citrus fruits has also been observed in different population of Germany and Finland [4, 5, 25]

Food sensitisation (positive SPT or raised specific IgE) is reported to be highly prevalent in subjects with atopic manifestations (25%) than in the general population [25, 26]. Previously in a group of patients with life-threatening asthma, 52.6% had positive SPT or elevated specific IgE to foods [9]. Food sensitisation is considered as an important risk factor for respiratory allergy [7-11] Wang *et al* reported that sensitivity to soy, wheat, peanut, fish and egg was significantly correlated with sensitisation to some aeroallergens. The similar trend was also observed in other studies [8, 9, 22, 23]. In the present study, 21% of asthma and rhinitis cases showed marked positive SPT (sensitisation) to one or more foods. It has been observed in the present study that sensitisation to food allergen (potential food allergy) was significantly associated with asthma and allergic rhinitis together followed by asthma and allergic rhinitis individually.

Clinical diagnosis of food allergy relies on history, SPT and specific IgE estimation [27]. Previously, elevated specific IgE was observed in 45% of asthma and 9% to 20% of rhinitis patients [10,11] in the present study 36.6 % cases with positive SPT showed raised specific IgE levels. Diagnostic decision points for specific IgE to predict symptomatic food allergy were established, but predicted probabilities varied among different foods and populations studied [28]. In the present study, food allergic cases showed marked positive SPT reaction and significantly elevated specific IgE levels (0.80-79 IU/mL) lemon and black gram, egg, rice, mushroom, fish, milk, maize, brinjal, paneer, cheese, beef and pork pea.

Food allergy affects family, social activities, stress level, meal preparation, school attendance and activity scores [29]. The advantage of the present study is that it has generated valuable knowledge about food allergens and allergy in older children and adults with asthma, rhinitis/or both in the country. It emphasises the need for accurate diagnosis by food challenges to prevent

individuals being on unnecessarily restricted diets leading to malnutrition. However, the diagnosis of food allergy is tricky in Indian population because of diverse dietary habits, and different meal preparations. But the timely detection of suspected food allergen(s) can help in developing avoidance strategy for the better management of the disease.

Conclusion

In the present study, prevalence of food allergy is estimated to be 21% of adolescent and adults with asthma, rhinitis or both with Egg whole, black gram and lemon rice, mushroom and corn milk and cheese, paneer and sardine fish maize and tamarind banana, sago and mutton pineapple, pork, potato and almond beef, lady finger and drumstick. More studies are recommended taking large population of patients to establish the diagnostic decision points for major food allergens in the country.

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